

Health aspects and functionality of millets & Utilization of millet hulls in antioxidant extraction



By
Subhash Palaniswamy
Yvan Gariépy
Valérie Orsat
Vijaya Raghavan



IDRC | CRDI

International Development Research Centre
Centre de recherches pour le développement international



Global Affairs
Canada

Affaires mondiales
Canada

Objectives

1. Map the functionality of millets

- *Map the functionality (health and nutritional) of millets*

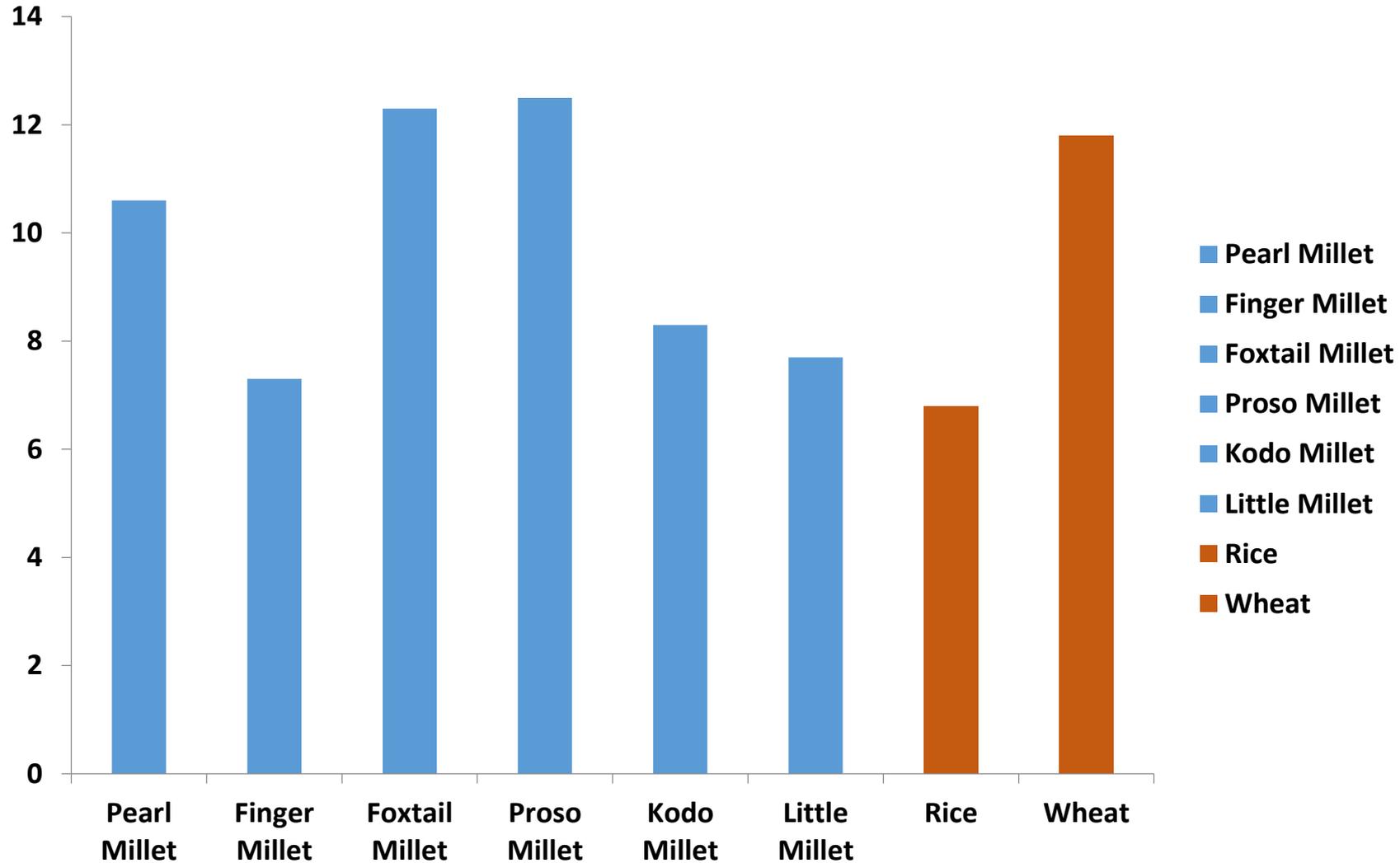
2. To extract antioxidants from kodo millet hulls

- *Applicability of microwaves*
- *Effect of process parameters*
- *Optimization of parameters for maximal extraction*

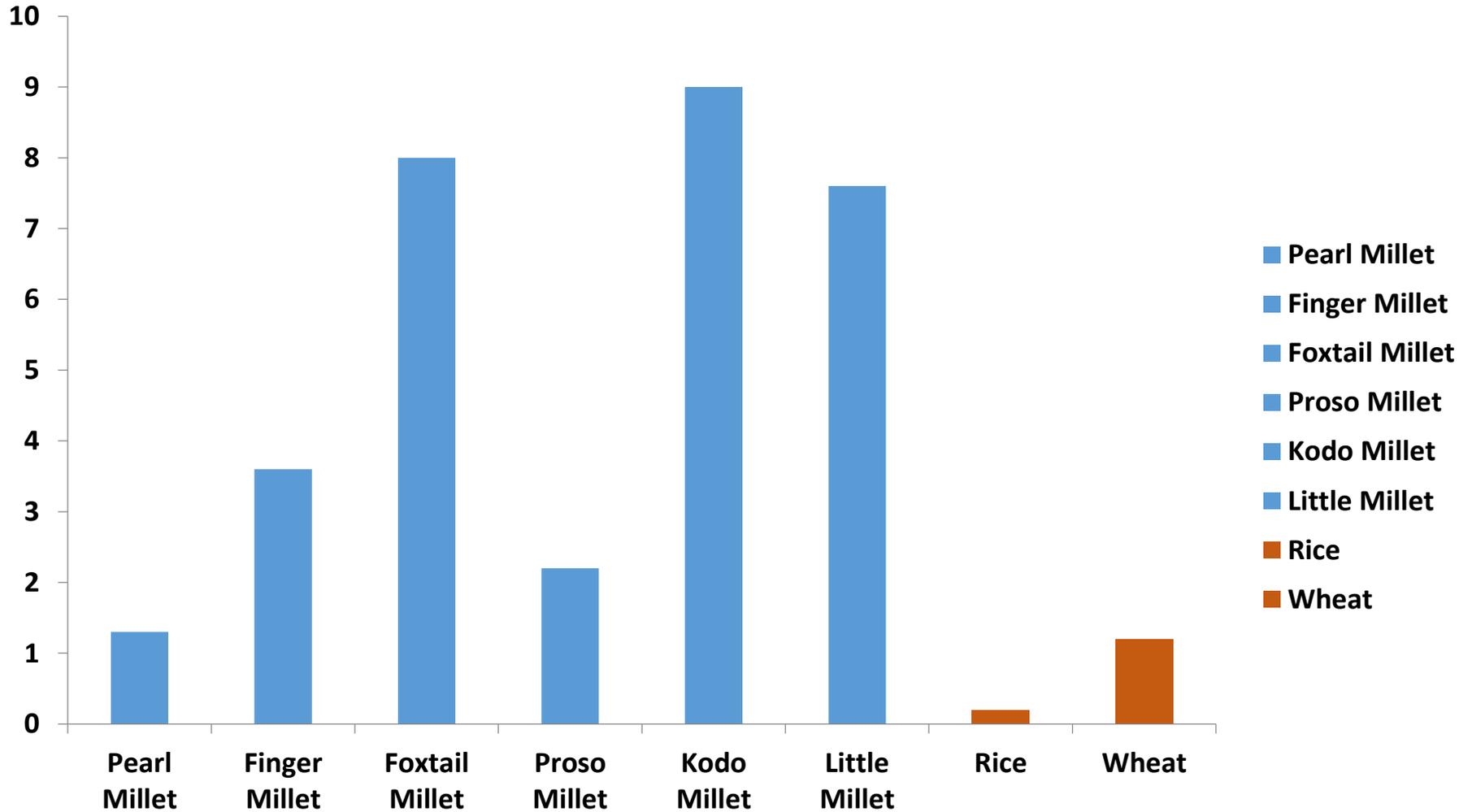
Nutritional Quality

- High protein and fiber (while being gluten free)
- Contains essential amino acids
- Good minerals content
 - Iron
 - Manganese
 - Phosphorus
 - Magnesium

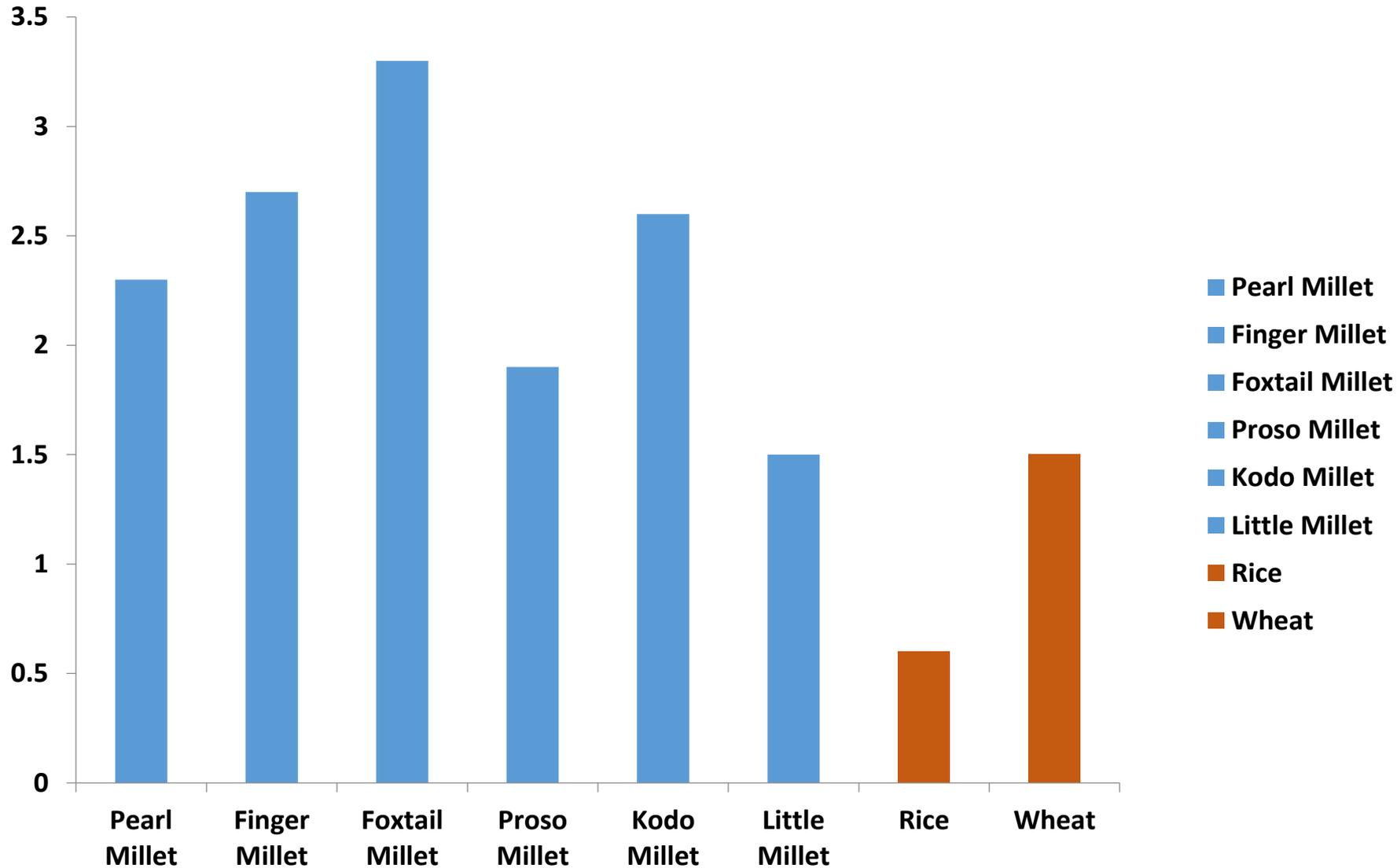
Protein Content, g



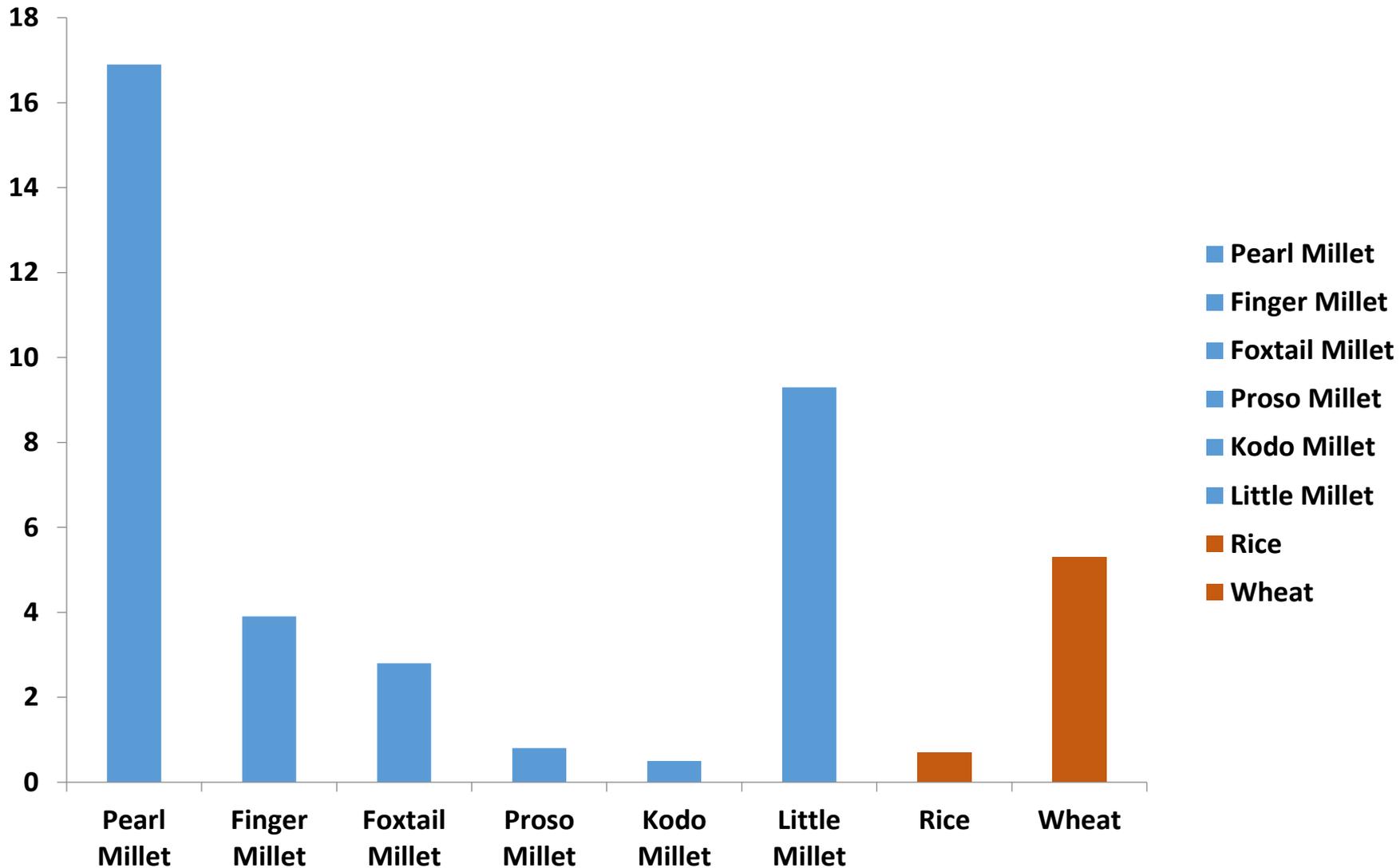
Fiber Content, g



Minerals Content, g



Iron Content, mg



Value-added millet-based products

Food formulations containing millets are being developed based on:

- ✓ processing parameters
- ✓ functional properties
- ✓ ready-to-eat convenience
- ✓ traditional foods' ingredients substitution
- ✓ marketability



Functionality of Millets

To use millets for value addition, it is required to have an understanding of their functional properties (physico-chemical) to exploit them best in a variety of food applications. Millets have particular:

Water holding capacity

Fat absorption capacity

Emulsifying, foaming, thickening, etc.

Nutritional content, and so on.....





Popped Millet



Germination



Fermentation

Health benefits

- Can help modulate blood sugar and type 2 diabetes
- Can help lower bad cholesterol
- Its phytonutrients can help prevent cancer
- Can improve skin condition with improved collagen cross-linking
- Its phenolics can reduce oxidative stress
- Its seedcoat extracts also have antibacterial and antifungal activities

Millets

Since many of the millets require to be de-hulled before processing for consumption. There rises a need to handle this residue biomass

The hulls are an excellent source of the plant's secondary metabolites. They represent a significant nutraceutical ingredient.

✓ We have explored extracting the valuable phyto-compounds from the hulls.

Antioxidant extraction



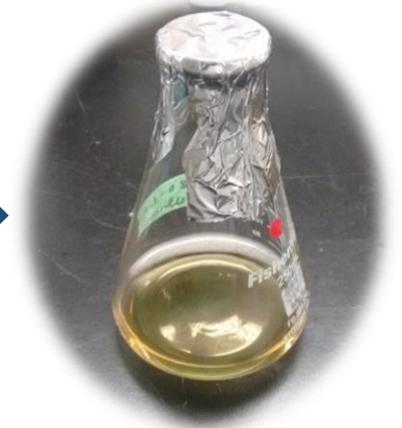
Background

- ✓ Millets are rich source of antioxidant molecules
- ✓ Phenolic compounds in millets are mainly concentrated in their outer hull layers
- ✓ Kodo millet hulls are found to have one of the highest antioxidant potential among millets
- ✓ Application of microwave energy could reduce extraction time and solvent consumption

Microwave extraction



Kodo millet hulls



Ethanolic extract

Process variables:

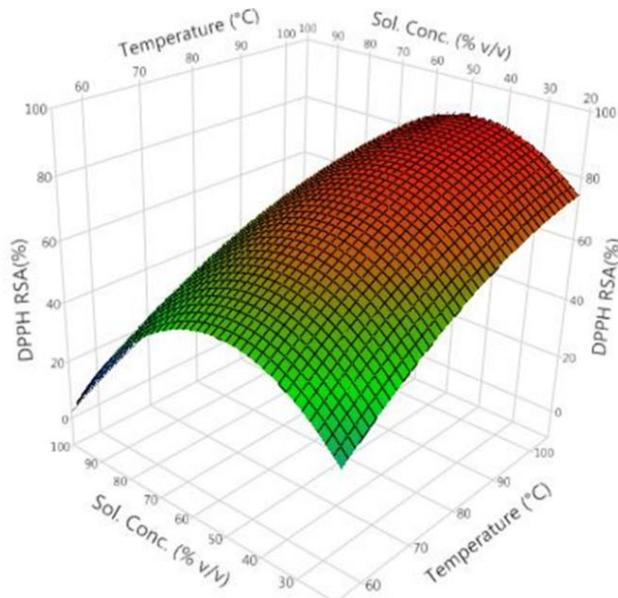
1	<i>Holding time</i>	<i>2, 4, and 6 minutes</i>
2	<i>Extraction temperature</i>	<i>60, 80 and 100°C</i>
3	<i>Ethanol concentration</i>	<i>30, 60 and 90% v/v</i>

Analysis of extracts

- Extracts were obtained based on the experimental runs derived using central composite design (CCD)
- Total phenol content and antioxidant capacity of the extracts were determined using established protocols
- Extracts showed positive results confirming their antioxidant potential
- Both total phenol content and antioxidant capacity were found to be temperature dependent

Optimization

- Response surface methodology was used to optimize the extraction
- Optimum conditions for antioxidant extraction from kodo millet hulls were predicted to be



Holding time	=	<i>5.48 minutes</i>
Extraction temperature	=	<i>100°C</i>
Ethanol concentration	=	<i>49.27 % v/v</i>

Summary

- ✓ Kodo millet hull waste can be utilized for extracting quality antioxidant using microwave energy
- ✓ Hull extracts were found to have high antioxidant potential and the extracts were further optimized to determine their optimal extraction conditions
- ✓ Millets warrant further attention in the foods we produced and their residue biomass following dehulling, also possesses market value

Thank you



Questions

